

**STATE OF CALIFORNIA
REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COAST REGION**

STAFF REPORT FOR REGULAR MEETING OF MAY 28-29, 2015

Prepared April 16, 2015

ITEM NUMBER: 16

SUBJECT: Morro Bay Groundwater Degradation

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This Action: Information/Discussion

SUMMARY

Linda Stedjee and other residents of the City of Morro Bay presented their case at the May 2014 Central Coast Water Board meeting that leaking sewers are the cause of elevated nitrate concentrations in City's supply wells near Morro Creek. Staff maintained its concurrence with the City's findings that the predominant source of nitrate is upstream irrigated agriculture. At the May 2014 meeting, the Board requested that the City collect caffeine samples (a wastewater indicator) from the City's supply wells to further investigate the possibility that leaking sewers are the cause of the elevated nitrate concentrations. The City subsequently sampled water from its supply wells, State supply water, and wastewater for caffeine and sucralose, an artificial sweetener and another wastewater indicator. According to preliminary results, caffeine was not detected in the supply wells, but sucralose was detected at very low but essentially identical concentrations in both the supply wells and the State water supply. These results, in conjunction with recent nitrate sampling, further corroborate staff's determination that sewage is not the predominant source of nitrate in the City's wells.

DISCUSSION

Background

The City of Morro Bay maintains a well field adjacent to Morro Creek, just west of Highway 1. Historically, this well field is one of two that supply most drinking water to Morro Bay. In recent years, the city has used the wells in this area only when imported water from the State Water Project is not available. The wells draw groundwater from a shallow alluvial aquifer. The wells have contained concentrations of nitrate above the state's maximum contaminant level of 45 mg/L as nitrate for several years, and as of July 2014, the northern-most supply well (MB-3) had a nitrate concentration of 142 mg/L as nitrate, and other wells have nitrate above or near the MCL. Potential sources of nitrate include irrigated agriculture, animal manure, septic systems, leaky sewer laterals, and leaky sewer mains.

In 2007 the City commissioned a report by Cleath and Associates, entitled *Morro Bay Nitrate Study*. The Cleath report concluded that agricultural fertilizer sources were the primary source of nitrate in the City's wells. In April 2008, Richard Sadowski and Marla Jo Bruton submitted information questioning the Cleath report's conclusions. Central Coast Water Board staff

reviewed both the Cleath report and the information submitted by Mr. Sadowski and Ms. Bruton and concurred with the Cleath report.

In 2013, Linda Stedjee submitted additional information and asked staff to reevaluate the situation. Staff again concluded that fertilizer is the main source of the nitrate degradation.

On November 1, 2013, Ms. Stedjee submitted a response to staff's letter. In her letter, Ms. Stedjee asked the Central Coast Water Board to intervene in the disagreement between her and staff. Ms. Stedjee presented her case that nitrate was from the City's leaky sewer system at the May 2014 Board Meeting. The City and Water Board staff maintained their position that nitrate was from agriculture fertilizers. However, the Board requested that the City collect caffeine samples from the City's supply wells to further investigate the possibility that leaking sewers are the cause of the elevated nitrate concentrations.

The City retained the services of Cleath-Harris Geologists to perform the caffeine sampling and reporting. However, because of objections to using Cleath-Harris from Ms. Stedjee, they did not complete the work according to their August 2014 work plan. The City attempted to retain Fugro Consultants to conduct the work in October 2014; however, Ms. Stedjee also had objections to using Fugro Consultants. The City then opted to collect the samples using their own staff.

Ms. Stedjee submitted an April 8, 2015 letter to the Central Coast Water Board responding to the results of the City's testing of wells for caffeine and sucralose (see Attachment 1). In her letter, Ms. Stedjee urged the Central Coast Water Board to take action over the levels of sucralose found in the City's groundwater.

Technical Analysis

The City provided preliminary results of the caffeine study on January 15, 2015. Based on the recommendation of Cleath-Harris, the City also collected samples for sucralose. Sucralose, a compound in some artificial sweeteners such as Splenda®, has a very low chemical/biological degradation rate and passes readily through groundwater aquifers without adsorbing to the aquifer materials (Eaton, 2014). These properties make it a good tracer in groundwater.

As shown in Table 1 below, the City collected samples from nine water supply wells (including four wells with historically high nitrate concentrations), wastewater, and the State water supply. The wastewater had concentrations of caffeine and sucralose of 280,000 and 3,300 nanograms per liter, respectively. Caffeine was not detected in any of the supply wells but was detected in State water at 2 nanograms per liter (ng/L). Sucralose was detected in 8 of 9 supply wells at concentrations between 64 and 170 ng/L, and in State water at 120 ng/L (Table 1). The northern-most supply well (Well No. 3) had a sucralose concentration of 100 nanograms per liter. Well No. 13 had a sucralose concentration of 110 ng/L. Note that this well is not used as a supply well and is located hydraulically upgradient of the City's sewer lines in the "narrows" of Morro Valley (Figure 1). It is the well located closest to irrigated agriculture in the east-west groundwater flow path. Also note that the nitrate concentration in this well was 146 mg/L as nitrate according to a December 2014 analysis, which was higher than concentrations measured in downgradient wells during the same month.

Table 1

Sample Location	Analyte	Results Parts per trillion (ng/L)
Flippos Well	Caffeine	ND
	Sucralose	91
High School Well 1	Caffeine	ND
	Sucralose	140
High School Well 2	Caffeine	ND
	Sucralose	170
Well 3	Caffeine	ND
	Sucralose	100
Well 4	Caffeine	ND
	Sucralose	64
Well 14	Caffeine	ND
	Sucralose	120
Well 15	Caffeine	ND
	Sucralose	90
Well 13	Caffeine	ND
	Sucralose	110
Manhole 13.36 (Wastewater)	Caffeine	280,000
	Sucralose	3,300
State Water	Caffeine	2
	Sucralose	120
1301 Little Morro Creek Rd	Caffeine	ND
	Sucralose	ND

Source: City of Morro Bay

Because caffeine was detected in raw sewage at 280,000 ng/L, the lack of caffeine detections in the sampled wells indicates that no significant component of wastewater reaches the City's supply wells. Because the laboratory method reporting limit for caffeine was 1 ng/L, it would require over a hundred-thousand-fold dilution factor between a hypothetical leak and well to reduce caffeine to non-detect levels.

Caffeine is commonly used as an indicator of the presence of wastewater in surface water and groundwater because of its prevalence in wastewater; however, it is subject to biodegradation (Lawrence Livermore National Laboratory, 2006), so it cannot be used as a conservative tracer. Because sucralose is a conservative tracer, the City also had the samples analyzed for sucralose. Detections in lower Morro Valley groundwater are widespread; however, it was also detected in State supply water and in an upgradient well (Well No. 13) at similar concentrations. This suggests that the source of sucralose in groundwater is not from sewage from Morro Bay's collection system, but possibly from 1) septic systems in unincorporated areas located upgradient of Well No. 13 and/or 2) percolation of landscape irrigation water from the City's

water supply (that mostly comes from State-supplied water). The sucralose concentration in raw sewage was a factor of between 20 to 50 times higher than the sucralose concentrations in the sampled wells. This compares with a nitrate concentration in raw sewage having a factor of between five times lower to three times higher than nitrate in sampled wells¹. This indicates that the source of elevated nitrate is from discharges located east of City well No. 13 and upgradient of the City's sewer lines.

Staff searched the State Water Board's Compilation of Water Quality Goals and found no listing for sucralose; therefore, sucralose is not recognized as an ecological or human health risk.

CONCLUSION

Based on the above facts, staff concludes that the results from the tracer study add to the existing multiple lines of evidence indicating that the primary source of nitrate in the City's wells is not the City's sewer system.

ATTACHMENTS

1. April 8, 2015 letter from Linda Stedjee
2. City of Morro Bay Caffeine & Sucralose Sampling Locations

RECOMMENDATION

Staff recommends that the Board take no action at this time and direct staff to not spend additional resources on this issue.

References

Eaton, A, 2014. "You Won't Find What You Don't Look For- Emerging Contaminants and Recycled Water Testing." Groundwater Resources Association Annual Conference, October 2014.

Lawrence Livermore National Laboratory, 2006. California GAMA Program: Fate and Transport of Wastewater Indicators: Results from Ambient Groundwater and From Groundwater Directly Influenced by Wastewater.

Cleath & Associates, 2007. Morro Basin Nitrate Study, prepared for the City of Morro Bay.

¹ Concentrations in wells from December 2014 sampling event (City of Morro Bay); nitrate concentration in raw sewage from Cleath & Associates (2007)